REMARKS

Applicants have carefully reviewed the Office Action mailed April 16, 2007, and thank Examiner Siedler for the detailed review of the pending claims. Claims 1, 2, 10, 16, 19, and 28 have been amended, and claim 13 has been canceled without prejudice or disclaimer of the subject matter contained therein. Support for these amendments can be found at least in paragraphs [0030] and [0054]-[0056] of the Specification, and claims 2, 13, and 19 as originally filed. No new matter has been added by way of these amendments. Accordingly, claims 1-12 and 13-31 remain pending.

At least for the reasons set forth below, Applicants respectfully traverse the rejections below. Further, Applicants believe that there are also reasons other than those set forth below why the pending claims are patentable, and reserves the right to set forth those reasons, and to argue for the patentability of claims not explicitly addressed herein, in future papers. Applicants respectfully request reconsideration of the present application in light of the remarks below.

I. Rejections Pursuant to 35 U.S.C. § 101

Claims 1-22 and 28-31 were rejected under 35 U.S.C. §101 as being allegedly directed to non-statutory subject matter. More specifically, the Examiner states that independent claims 1, 10, 16, and 28 "fall within a judicial exception as they merely manipulate an abstract idea (mathematical algorithm) without a claimed limitation to a practical application." The Examiner further states that the "claimed method is merely a series of steps to be performed on a computer, which manipulates a mathematical algorithm without any claimed limitation to a practical application." *See Office Action dated 4/16/2007, page 2.* Applicants respectfully traverse this rejection.

A. Statutory Subject Matter under 35 U.S.C. §101

Section 101 states that "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title." However,

claims directed to nothing more than abstract ideas, such as mathematical algorithms, natural phenomena, and laws of nature fall into a judicial exception to Section 101, and are not eligible for patent protection. *Diamond v. Diehr*, 450 U.S. at 185, 209 USPQ at 7.

Additionally, the USPTO has promulgated new standards in the form of "Interim Guidelines for Examination of Patent Applications for Patent Subject Matter Eligibility" (October 26, 2005). The Interim Guidelines explain that claims falling within the judicial exception may nonetheless define patentable subject matter where the "claimed invention otherwise produces a useful, concrete and tangible result." *See Interim Guidelines at page 19.* Moreover, "[t]he tangible requirement does not necessarily mean that a claim must either be tied to a particular machine or apparatus or must operate to change articles or materials to a different state or thing." *Id.* at 21.

B. Independent Claims 16 and 28

Applicants first submit that each of claims 16 and 28 recite machine elements having a practical application and therefore define patentable subject matter. As the Interim Guidelines point out,

> "A claim limited to a machine or manufacture, which has a practical application, is statutory. In most cases, a claim to a specific machine or manufacture will have a practical application. See *Alappat*, 33 F.3d at 1544, 31 USPQ2d at 1557 ("the claimed invention as a whole is directed to a combination of interrelated elements which combine to form a machine for converting discrete waveform data samples into anti-aliased pixel illumination intensity data to be displayed on a display means. This is not a disembodied mathematical concept which may be characterized as an 'abstract idea,' but rather a specific machine to produce a useful, concrete, and tangible result."); and *State Street*, 149 F.3d at 1373-74, 47 USPQ2d at 1601-02 ("the transformation of data, representing discrete dollar amounts, by a machine through a series of mathematical calculations into a final share price, constitutes a practical application of a mathematical algorithm, formula, or calculation, because it produces 'a useful, concrete and tangible result' – a final share price momentarily fixed for recording and reporting purposes and even accepted and relied upon by regulatory authorities and in subsequent trades."). Also see *AT&T*, 172 F.3d at 1358, 50 USPQ2d at 1452 (Claims drawn to a

> long-distance telephone billing process containing mathematical algorithms were held patentable subject matter because the process used the algorithm to produce a useful, concrete, tangible result without preempting other uses of the mathematical principle.)."

See Interim Guidelines at p.38-39. (Emphasis added).

Applicants point out that each of claims 16 and 28 positively recite machine limitations. More specifically, claim 16 recites an "audio classification device comprising: a signal analysis component configured to receive an audio signal and process the audio signal by at least one of the converting the audio signal to the frequency domain and generating cepstral features for the audio signal; and a decoder..." Claim 28 recites a "means for classifying a sound in an audio signal as a vowel class... means for classifying the sound in the audio signal as a fricative class... and means for classifying the sound in the audio signal based on at least one non-phoneme based model."

Further, each of the machine-based recitations in claims 16 and 28 has a practical application explicitly defined by the claims. Merely by way of example, claim 16 recites that the decoder is "configured to classify portions of the audio signal as belonging to at least one of a plurality of classes." As a further example, claim 28 recites a "means for classifying a sound in an audio signal as a vowel class," and therefore requires the "means" to be configured for "classifying a sound in an audio signal as a vowel class." Accordingly, Applicants submit that claims 16 and 28 cannot be reasonably characterized as mere "abstract ideas" or "mathematical algorithms" that do not have a "claimed limitation to a practical application." To the contrary, each claim recites machine elements having practical applications. Reconsideration and withdrawal of the present rejection as to those claims is therefore respectfully requested.

C. Independent Claims 1 and 10

Although claims 1 and 10 are method claims, each recite concrete elements that rise above "manipulat[ing] abstract ideas" or "mathematical algorithms," and therefore also do not fall within the judicial exception to Section 101. Moreover, claims 1 and 10 each recite "useful, concrete, and tangible results."

Claim 1 recites a "method for classifying an audio signal containing speech information, the method comprising: receiving the audio signal; [and] classifying a sound in the audio signal..." Claim 10 recites a "method of training audio classification models, the method comprising: receiving a training audio signal; receiving phoneme classes corresponding to the training audio signal; training a first Hidden Markov Model (HMM), based on the training audio signal and the phoneme classes, to classify speech as belonging to a vowel class when the first HMM determines that the speech corresponds to a sound represented by a set of phonemes that define vowels..." An "audio signal," "sound," and a "phoneme class," merely as examples, are all tangible elements that rise above a mere "abstract idea" or "mathematical algorithm." Accordingly, it is respectfully submitted that claims 1 and 10 do not fall within judicial exceptions to Section 101.

Moreover, claims 1 and 10 each recite "useful, concrete, and tangible" results. Each of the claims recites useful limitations for classifying sounds that produce a tangible result in the form of the classified sound, as an example. Further, claims 1 and 10 each recite repeatable processes that produce predictable results. As the Interim Guidelines point out,

> Another consideration is whether the invention produces a "concrete" result. Usually, this question arises when a result cannot be assured. In other words, the process must have a result that can be substantially repeatable or the process must substantially produce the same result again. *In re Swartz*, 232 F.3d 862, 864, 56 USPQ2d 1703, 1704 (Fed. Cir. 2000) (where asserted result produced by the claimed invention is "irreproducible" claim should be rejected under section 101). The opposite of "concrete" is unrepeatable or unpredictable.

Merely by way of example, the methods of claims 1 and 10 recite a step for "classifying a sound in the audio signal as a vowel class when a first phoneme-based model determines that the sound corresponds to a sound represented by a set of phonemes that define vowels," and "training a first Hidden Markov Model (HMM)... to classify speech as belonging to a vowel class when the first HMM determines that the speech corresponds to a sound represented by a set of phonemes that define vowels," respectively. These steps clearly lead to the predicable, repeatable result of

classifying a sound in a vowel class when a classification model determines that the sound corresponds to a set of phonemes that define vowels.

Accordingly, claims 1, 10, 16, and 28 each recite patentable subject matter for at least the above reasons. Dependent claims 2-9, 11, 12, 14, 15, 17-22, and 29-31 each depend from claims 1, 10, 16, and 28, and are therefore also believed to recite patentable subject matter for at least the same reasons as those provided above for claims 1, 10, 16, and 28. Reconsideration and withdrawal of the present rejection is respectfully requested.

II. Rejections Pursuant to 35 U.S.C. §102

Claims 1, 3, 6, 7, 10-12, 14, 15, and 28 were rejected under 35 U.S.C. §102(b) as being allegedly anticipated by Liu ("Fast Speaker Change Detection for Broadcast News Transcription and Indexing," The Proceedings of Eurospeech 1999, Budapest, Hungary; hereinafter "Liu"). This rejection is respectfully traversed.

A. Anticipation

To anticipate a claim, the reference must teach every element of the claim. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the ... claim. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

B. Claims 1, 10, and 28

Independent claims 1, 10 and 28 have been amended, and now recite subject matter previously contained in dependent claims 2 and 13. Claims 1 and 28 each recite "at least one model for classifying the sound in the audio signal based on bandwidth," and claim 10 recites "training at least one model to classify the sound based on a bandwidth of the sound." Liu neither teaches nor suggests classifying a sound "based on bandwidth." In fact, the Examiner

acknowledges as much, relying instead upon other prior art references in combination with Liu to reject dependent claims 2 and 13 under 35 U.S.C. §103, as further discussed below. More specifically, the Examiner states that "Liu does not disclose wherein the at least one non-phoneme based model includes models for classifying the sound in the audio signal based on bandwidth," and further "does not disclose training at least one model to classify the sound based on a bandwidth of the sound. *See Office Action dated 4/16/2007, page 8; page 10.* Moreover, as will be further described below, Liu teaches away from "classifying the sound in the audio signal based on bandwidth." Accordingly, it is believed that independent claims 1, 10, and 26 are allowable over Liu. Dependent claims 3, 6, 7, 11, 12, 14, and 15 depend from claims 1 and 10, and are therefore also allowable over Liu for at least the same reasons as claims 1 and 10. Withdrawal of the present rejection is therefore respectfully requested.

III. Rejections Pursuant to 35 U.S.C. §103

The Examiner rejected claims 8, 9, and 31 under 35 U.S.C. §103(a) as being allegedly unpatentable over Liu. Further, claims 2, 4, 5, 13, 16-22, 29 and 30 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Liu in view of Leung ("A Comparative Study of Signal Representations and Classification Techniques for Speech Recognition," I.E.E.E. International Conference on Acoustics, Speech and Signal Processing, ICASSP'93 27-40 Apr, 1993, vol. 2, pages 680-683; hereinafter "Leung"). Finally, claims 23-27 were rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Liu in view of Leung, in further view of Colbath ("Spoken Documents: Creating Searchable Archives from Continuous Audio," Proceedings of the 33rd Hawaii International Conference on System Sciences 2000; hereinafter "Colbath"). These rejections are respectfully traversed.

A. Obviousness

MPEP Section 2143 sets forth the basic requirements for the Patent and Trademark Office to establish prima facia obviousness as follows: "To establish a prima facia case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary

skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations."

B. Independent Claims 1, 10, 16, 23, and 28

Independent claim 1 recites:

> receiving the audio signal;
> classifying a sound in the audio signal as a vowel class when a first phoneme-based model determines that the sound corresponds to a sound represented by a set of phonemes that define vowels;
> classifying the sound in the audio signal as a fricative class when a second phoneme-based model determines that the sound corresponds to a sound represented by a set of phonemes that define consonants; and
> classifying the sound in the audio signal based on at least one non-phoneme based model, the at least one non-phoneme based model including at least one model for classifying the sound in the audio signal based on bandwidth.

(Emphasis added).

Independent claim 10 recites:

> receiving phoneme classes corresponding to the training audio signal;
> training a first Hidden Markov Model (HMM), based on the training audio signal and the phoneme classes, to classify speech as belonging to a vowel class when the first HMM determines that the speech corresponds to a sound represented by a set of phonemes that define vowels;
> training a second HMM, based on the training audio signal and the phoneme classes, to classify speech as belonging to a fricative class when the second HMM determines that the speech corresponds to a sound represented by a set of phonemes that define consonants; and
> training at least one model to classify the sound based on a bandwidth of the sound.

(Emphasis added).

Similarly, independent claim 16 has been amended, and recites:

> a decoder configured to classify portions of the audio signal as belonging to at least one of the plurality of classes, the classes including
>
> a first phoneme-based class that applies to the audio signal when a portion of the audio signal corresponds to a sound represented by a set of phonemes that define vowels,
>
> a second phoneme-based class that applies to the audio signal when a portion of the audio signal corresponds to a sound represented by a set of phonemes that define consonants, and
>
> at least one non-phoneme class;
>
> wherein the decoder determines the at least one non-phoneme class using models that classify the portions of the audio signal based on bandwidth.

(Emphasis added).

Independent claim 23 recites:

> an indexer configured to receive input audio data and generate a rich transcription from the audio data, the indexer including:
>
> audio classification logic configured to classify the input audio data into at least one of a plurality of broad audio classes, the broad audio classes including a phoneme-based vowel class, a phoneme-based fricative class, [and] a non-phoneme based bandwidth class...

(Emphasis added).

Further, independent claim 28 has been amended, and recites:

> means for classifying a sound in an audio signal as a vowel class when a first phoneme-based model determines that the sound corresponds to a sound represented by a set of phonemes that define vowels;
>
> means for classifying the sound in the audio signal as a fricative class when a second phoneme-based model determines that the sound corresponds to a sound represented by a set of phonemes that define consonants; and
>
> means for classifying the sound in the audio signal based on at least one non-phoneme based model, the at least

> one non-phoneme based model including at least one model for classifying the sound in the audio signal based on bandwidth.

(Emphasis added). Accordingly, among the other recitations, each of independent claims 1, 10, 16, 23, and 28 are also directed to systems or methods that classify a sound based on correspondence of the sound to a "vowel" class and a "fricative" class, and also based on a "bandwidth" of the sound.

1. "based on bandwidth " and "a non-phoneme based bandwidth class"

It is respectfully submitted that the prior art of record fails to teach or suggest "at least one model for classifying the sound in the audio signal based on bandwidth," "training at least one model to classify the sound based on a bandwidth of the sound," "models that classify the portions of the audio signal based on bandwidth," or a "non-phoneme based bandwidth class."

Liu is directed to a speaker change detection system "designed for fast transcription and audio indexing." *See Liu; Abstract, lines 1-3.* Liu describes a baseline speaker change detection algorithm employing 45 separate phone classes for the male gender, 45 phone classes for the female gender, and 1 non-speech class. *See Liu, Section 3, paragraph 3.* As a solution to the problems inherent in employing many phone and non-speech classes, Liu employs a collapsed class inventory having 4 broad phoneme-based classes and 4 non-speech classes used to break up continuous sound input into discrete utterances, thereby permitting the algorithm to run more quickly. *See Liu; Abstract lines 5-12.* The system of Liu therefore outputs "a sequence of phone classes and non-speech labels with time." *See Liu, Section 3, paragraph 7.* Liu increments this output one phone at a time, analyzing the boundaries between each discrete class and non-speech label to determine whether a speaker change has occurred. *See Liu, Section 5: "Phone-based speaker change detection".* By employing a reduced number of phone and non-speech classes, Liu increases decoding speed by approximately 30 times over the base algorithm. *See Liu, Section 5: "Speed".* As Liu is generally directed to decreasing the number of parameters analyzed to determine speaker changes quickly, Liu not only fails to suggest, but teaches away from, "at least one model for classifying the sound in the audio signal based on bandwidth,"

"training at least one model to classify the sound based on a bandwidth of the sound," "models that classify the portions of the audio signal based on bandwidth," or a "non-phoneme based bandwidth class."

Applicants note that the Examiner admits of Liu's failure to disclose or suggest classification according to bandwidth of a sound, and relies on Leung for this element of the independent claims, stating:

> Leung discloses an evaluation of classification techniques for speech recognition, including a comparison between telephone quality and wide-band versions of the same speech (page 680, Introduction, last paragraph). Leung discloses that the effectiveness of the classification technique may depend on the quality of the speech signal (page 682, first paragraph), and that the telephone network inflates the phonetic classification error rate (page 682, first paragraph). Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to classifying the sound in the audiop signal based on bandwidth in Liu, since it would enable the system to determine the optimum classifier the use based on signal characteristics, as indicated in Leung (page 682, first and second paragraph, and Figures 1 and 2, *the figure indicate the best classifier and features to use depending on the type of signal*).

See Office Action dated 4/16/2007, pages 8-9. However, it is respectfully submitted that the Examiner's characterization of Leung is overbroad. Leung merely observes the effect of network quality on overall error rate for a plurality of classification models, ultimately concluding that "the degradation due to the telephone network is quite consistent across the classifiers and signal representations." *See Leung, page 682, 2nd paragraph, lines 13-14.* Further, Leung states that "for any particular classifier and signal representation, the telephone network inflates the phonetic classification error rate by a factor of approximately 1.3." *See Leung, page 682, 2nd paragraph, lines 15-17.* Accordingly, the Examiner's conclusion that "it would have been obvious to one of ordinary skill in the art at the time of the invention to classifying the sound in the audio signal based on bandwidth in Liu, since it would enable the system to determine the optimum classifier the use based on signal characteristics," fails to

address the conclusion of Leung that degradation in network quality merely universally increases error rate across all classifiers and signal representations. Leung makes no conclusion whatsoever that any particular classifiers or signal representations are better than others for any given network, and further makes no connection between the "bandwidth" of a sound and accuracy of phonetic classification.

Accordingly, the prior art of record fails to teach or suggest "at least one model for classifying the sound in the audio signal based on bandwidth," "training at least one model to classify the sound based on a bandwidth of the sound," "models that classify the portions of the audio signal based on bandwidth," or a "non-phoneme based bandwidth class." It is therefore respectfully submitted that independent claims 1, 10, 16, 23, and 28 are allowable over the prior art of record for at least the above reasons.

2. *Lack of motivation to modify or combine*

It is respectfully submitted that one of skill in the art at the time the invention was made would not have combined the prior art references relied on by the Examiner in order to re-create the arrangement of claims 1, 10, 16, 23, and 28. The independent claims are directed to methods and systems that classify sounds based on a "bandwidth" of the sound, in addition to employing traditional phoneme based classes, such as a "vowel" class and a "fricative" class.

The entire thrust of Liu, which is increasing speed of recognizing speaker changes, is at odds with the arrangement recited by independent claims 1, 10, 16, 23, and 28, improving accuracy of speech recognition by additionally analyzing bandwidth of the sounds. As described above, Liu is generally directed to increasing speed of speaker change detection by decreasing the number of classes and/or parameters analyzed. Liu therefore not only fails to suggest, but teaches away from classifying sound based on models other than the phoneme classes and the four non-speech classes explicitly disclosed therein.

Accordingly, one of ordinary skill in the art at the time the invention was made would not have added an additional model or class such as "at least one model for classifying the sound in the audio signal based on bandwidth," "training at least one model to classify the sound based

on a bandwidth of the sound," "models that classify the portions of the audio signal based on bandwidth," or a "non-phoneme based bandwidth class," to the method of Liu.

For the same reasons, Liu would not have been combined with Leung by one of ordinary skill in the art at the time the invention was made to re-create the claimed invention. Leung generally examines the effect of several parameters on error rates of classification techniques for speech recognition, including matching of a signal processing technique with the classification technique, effect of feature extraction procedure on accuracy of the classification technique, and effect of speech signal quality on effectiveness of a signal processing or classification technique. *See Leung, Introduction, 2nd paragraph.* As opposed to Liu's stated goal of increasing speed of recognizing speaker changes, Leung emphasizes quality of various classification techniques, studying effects of the above parameters on classification error rate.

Accordingly, one of skill in the art at the time the invention was made would not have combined the cited references to re-create the claimed invention. It is therefore respectfully submitted that independent claims 1, 10, 16, 23, and 28 are allowable over the prior art of record.

C. Independent Claim 23: "*...non-phoneme based gender class...*"

Independent claim 23 additionally recites "the broad audio classes including a phoneme-based vowel class, a phoneme-based fricative class, a non-phoneme based bandwidth class, and a non-phoneme based gender class." In addition to the reasons cited above for the allowability of claim 23 over the prior art of record, it is respectfully submitted that the prior art of record additionally teaches away from employing a "non-phoneme based gender class."

The Examiner states that "Liu discloses... a non-phoneme based gender class (Section 3 Phone-Class Decode, paragraphs 3 and 4)." However, Applicants point out that this portion of Liu merely discloses a gender-dependent phone model as a baseline that possesses a number of disadvantages as a result of employing gender-based models. More specifically, in regard to the baseline gender-dependent models, Liu states that

> ...there are some drawbacks. There are some cases in which a sequences {sic} of gender errors are made on short segments in particular. Background noise may also affect the gender detection. This makes the output gender labels

> somewhat noisy and some complicated heuristic rules are needed to smooth the results before they can be useful. The 91-phone baseline decoder is also quite slow.

See Liu, Section 3: paragraph 3, lines 9-15. As a solution to the problems presented by the baseline gender-dependent model, Liu employs a gender-independent approach, in order to "avoid using any complicated heuristic rules that may not be robust." *See Liu, Section 3, last paragraph.* Accordingly, Liu directly teaches away from a "non-phoneme based gender class." It is therefore respectfully submitted that for at least the above reasons, independent claim 23 is allowable over the prior art of record.

D. Dependent Claims

Independent claims 1, 10, 16, 23, and 28 are believed to be allowable over the prior art of record, as described above. Dependent claims 2-9, 11, 12, 14, 15, 17-22, 24-27, and 29-31 depend from claims 1, 10, 16, 23, and 28, and are also patentable by being dependent on an allowable base claim. Moreover, the dependent claims recite independently patentable subject matter. Merely by way of example, the prior art of record, and in particular Liu, specifically teaches away from classifying sound "based on speaker gender," as recited in claims 2 and 19, and "based on gender of a speaker," as recited in claim 14. As described above in regard to independent claim 23, Liu specifically teaches away from employing gender-based classification models, pointing out that a baseline model employing gender-dependent models requires additional heuristics to provide adequate robustness, and is generally slow. *See Liu, Section 3: paragraph 3, lines 9-15.* Accordingly, the dependent claims are allowable over the prior art of record for at least the above reasons.

CONCLUSION

All rejections have been addressed. In view of the above amendments and remarks, Applicants believe the pending application is in condition for allowance.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 18-0013, under Order No. 65632-0233 from which the undersigned is authorized to draw.

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Respectfully submitted,

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